Exponent

EXTERNAL MEMORANDUM

TO: Chris Weis, U.S. EPA

FROM: Joyce Tsuji

DATE: October 6, 1999

CONTRACT: 8601184.001 0101

SUBJECT: Arsenic and Lead Exposure via Homegrown Vegetables

As promised, I am sending some information regarding arsenic and lead exposure in homegrown vegetables. This memo reviews evidence on such exposures at smelting and mining sites, and I have attached the relevant sections you requested on vegetable uptake factors of metals from the risk assessment prepared for U.S. EPA Region 10 at the Tacoma smelter site.

Evidence from other sites includes the following:

- Soil in vegetable gardens has been shown to have lower metals concentrations than soil from other residential areas at the East Helena Smelter site (CDC et al. 1983), the Tacoma Smelter site (Polissar 1987), and the Anaconda Smelter site (Hwang et al. 1997). The decrease in concentrations is likely due to the amending of garden soils with compost, plant debris, organic fertilizer, or imported soil. The addition of nutrients or minerals to soil to increase plant growth would also decrease the amount of metals taken up by plants.
- The University of Washington Pathways study (Polissar 1987; Polissar et al. 1990) noted that accumulation of metals in home-grown vegetables in the Tacoma neighborhood was not a significant health concern. Concentrations of arsenic in vegetables were found to be within the range reported for uncontaminated vegetables. In addition, urinary arsenic levels of residents indicated that exposure to arsenic did not vary between seasons in which home-grown produce was eaten and seasons without home-grown produce.
- At the Anaconda smelter site, eating locally grown crops was not related to increased arsenic exposure as determined by urinary arsenic levels in children (Hwang et al. 1997).

To further investigate this issue, I examined all environmental exposure studies that I could immediately locate from various sites, including: Bingham Creek, UT (arsenic and lead examined; University of Cincinnati 1997a); Leadville, CO (lead, University of Cincinnati

1997b); Sandy, UT (lead, University of Cincinnati 1997c); Palmerton, PA (lead, Advanced Geoservices 1996; lead and cadmium, ATSDR 1994); Coeur d' Alene Basin (lead and cadmium, IDWH 1999); Midvale, UT (lead, Bornschein et al. 1991); Aspen, CO (lead, ATSDR 1992); Globleville, CO (arsenic, lead, Colorado Department of Health 1994); and Butte, MT (lead, BSBDH and University of Cincinnati 1992). None of these studies showed that having a vegetable garden or eating locally grown vegetables increased exposure to these metals.

Please also note that much of the arsenic in vegetables such as potatoes, tomatoes, carrots, beans, and onions is in the relatively non-toxic organic form (Yost et al. 1998; Schoof et al. 1999). Only the percentage of arsenic that is in the inorganic form should be used in calculating health risks using the arsenic cancer slope factor.

Please let me know if I can provide any additional information.

cc: David Mellard, ATSDR

Attachment

References

Advanced Geoservices Corp. 1996. Palmerton lead exposure study, fall, 1994. Performed for the Palmerton Environmental Task Force by AGC, Northeastern Pennsylvania Vector Control, University of Cincinnati.

ATSDR. 1992. Final report: Clear Creek/Central City mine waste exposure study. Part 1: Smuggler Mountain site. PB93-151371. U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, Division of Health Studies, Atlanta, GA.

ATSDR. 1994. Biological indicators of exposure to cadmium and lead, Part I, Palmerton, Pennsylvania. Agency for Toxic Substances and Disease Registry, U.S. Department of Commerce, National Technical Information Services, Atlanta, Georgia.

Bornschein, R.L., C.S. Clark, W. Pan, and P. Succop. 1991. Midvale community lead study. Chem. Spec. Bioavail. 3:149–162.

BSBDH and University of Cincinnati. 1992. The Butte-Silver Bow County environmental health lead study. Final Report. Butte-Silver Bow Department of Health and University of Cincinnati.

Centers for Disease Control (CDC), Lewis and Clark County Health Department, Montana Department of Environmental Health. 1983. East Helena, Montana child lead study, summer 1983. U.S. Department of Health and Human Services, Atlanta, GA.

Colorado Department of Health, Division of Disease Control and Environmental Epidemiology. 1994. The Globeville childhood metals study, an exposure study. Denver, Colorado.

Hwang, Y., R.L. Bornschein, J. Grote, W. Menrath, and S. Roda. 1997. Environmental arsenic exposure of children around a former copper smelter site. Environmental Research, **72**, 72–81.

IDHW. 1999. Couer d'Alene River basin environmental health exposure assessment draft final report. Idaho Department of Health and Welfare, Boise, ID.

Polissar, L. 1987. Ruston/Vashon Arsenic Exposure Pathways Study. Final Report. Prepared under contract with the Washington Department of Ecology. School of Public Health and Community Medicine, University of Washington, Seattle, WA. 21 March.

Polissar, L., K. Lowry-Coble, D. A. Kalman, J.P. Hughes, G. van Belle, D.S. Covert, T.M. Burbacher, D. Bolgiano, and N. K. Mottet. 1990. Pathways of human exposure to arsenic in a community surrounding a copper smelter. Environmental Research, **54**, 29–47.

Schoof, R.A., L.J. Yost, J. Eickhoff, E.A. Crecelius, D.W. Cragin, D.M. Meacher, D.B. Menzel. 1999. A market basket survey of inorganic arsenic in food. Food Chem. Toxicol. 37(8): 838–846.

University of Cincinnati. 1997a. Bingham Creek environmental health lead and arsenic exposure study. Final Report. University of Cincinnati, Department of Environmental Health.

University of Cincinnati. 1997b. Leadville/Lake County environmental health lead study. Final Report. University of Cincinnati, Department of Environmental Health.

University of Cincinnati. 1997c. Sources and pathways of lead exposure in Sandy, Utah (1993–1994). Draft Report. University of Cincinnati, Department of Environmental Health.

Yost L.J., R.A. Schoof, and R. Aucoin. 1998. Intake of inorganic arsenic in the North American diet. Human and Ecological Risk Assessment 4(1):137-152.